HIGH-SPEED RAIL PROSPECTS
IN THE CALGARY-EDMONTON CORRIDOR

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1. THE PROJECT

- A Federal-Provincial mid-1970's study concluded that passenger rail between Calgary and Edmonton could be useful and feasible by the late 1980's, based on estimates of travel growth and corridor characteristics. It recommended that a right-of-way be identified and protected in the early 1980's.

- Alberta asked the Canadian Transport Commission to postpone a decision on existing passenger rail service in the corridor until the province had completed a detailed study. Alberta Economic Development then received approval to proceed with the "Calgary-Edmonton Intercity Passenger Rail Study".

- Phase I of this study consisted of five sub-studies aimed at identifying a role for passenger rail. Consultants, Loram International Ltd., concluded that a high-speed rail service potentially could be useful but that additional analyses were required. Phase II was the result: four sub-studies on modal demand, route assessment, operational costs, and financial matters.

- Phase III was aimed at refining the earlier results, so that a decision could be made whether or not to proceed with design, engineering and protection of right-of-way, should the government so decide. Included were studies of the route, downtown access, facilities, rolling stock, and economic and financial aspects.

- This presentation provides the results of all work completed to date which clearly demonstrates that high-speed rail service in the Calgary-Edmonton corridor is technically feasible and economically-viable, and that it would contribute to a revival of the province's engineering and construction industries.

2. THE CORRIDOR AND THE PROBLEM

- Within North America the Calgary-Edmonton corridor is very significant in terms of density of scheduled frequency of transportation services. Cataloguing all short-haul jet-serviced corridors (i.e., under 45 minutes or about 320 km), Calgary-Edmonton is ranked in 5th place behind Los Angeles-San Diego:

Rank	Corridor	Daily Flights (one-way)	Distance (km)	Total Population (thousands)
1	Dallas*-Austin	67	310	2,915
2	Seattle-Portland	66	275	2,850
3	Phoenix-Tucson	49	190	2,040
4	Los Angeles-San Diego	41	215	9,340
5	Calgary-Edmonton	35	300	1,250
6	Atlanta-Birmingham	34	240	2,875

(* Dallas and Ft. Worth)

Out of a total of 130 major bus corridors, Calgary-Edmonton is in the top dozen by density of service:

Hourly Express Service	More-Than-Hourly Express Service
New York-Boston	Philadelphia-Atlantic City
New York-Washington	Montreal-Quebec City
New York-Philadelphia	San Francisco-Sacramento
Calgary-Edmonton	New York-Hartford
Montreal-Ottawa	New York-Atlantic City
Boston-Springfield	
Chicago-Milwaukee	

- The relatively short - 300 km - Calgary-Edmonton corridor allows the business traveller to leave at 7:00 a.m. returning by 6:00 p.m. and put in a full-day's work (7 hours) in the destination city. This characteristic distinguishes it from such corridors as Toronto-Montreal, where high-speed rail would not provide for a full-working day. Thus, the market penetration of a high-speed service in the corridor, is substantially higher than anticipated, particularly in comparison to VIA's estimate.

- The complementary relationship of Calgary and Edmonton accentuates the need for improved passenger transport links. The corridor has one of the highest per capita trip generation rates of any Canadian city pair. Thus, for transportation planning purposes, residents of the two Alberta cities behave and travel more like people in much larger cities - perhaps cities of 1.5 million population each. In addition, the propensity to use public transportation modes is comparatively high. Airline, bus or rail service account for 44 per cent of trips beginning in Calgary and ending in Edmonton, or vice versa (hereafter referred to as Calgary-Edmonton traffic).

- The total Calgary-Edmonton travel demand is forecast to grow at an average of 2.5 per cent annually (based on the latest Alberta Treasury population figures). By 1995, it is estimated that there will be 3.7 million annual person trips, which is 50 per cent higher than in 1981, and volumes will double by the year 2005.

- The need for improved business linkages (which account for half of all corridor trips) will develop with future clustering of manufacturing, service, financial and government sectors in the respective cities. Alberta industry will require less-costly, more efficient links to remain competitive, and employers will desire better links as part of the enhancement of the quality of life of their employees.

- Air fares in the corridor have grown by 10% annually over the past two decades. In 1963 the ratio of airbus to highway bus fares was around 2:1 and by 1984 it was 4:1. The growth in air fares is largely a product of the changing operating economics of jets over a relatively short haul - 250 km.

- Airlines are currently exploring the possible alternatives to short haul jet service. For example, Lufthansa has successfully supplemented air service between Cologne and Frankfurt International Airport with fast rail service; other carriers are substituting slower but cheaper-to-operate turbo-prop aircraft.

- A noise abatement program has been instituted (1984) at the Edmonton Municipal Airport by City Council which will:

  - have "implications on the number of daily flights"; and
  - "necessitate retirement, replacement or retrofit of noisier aircraft".

  It is quite possible that the noise reduction objectives will negatively affect the airport's ability to cope with future traffic growth. Even though quieter aircraft may be available, the industry's ability to re-equip themselves and at the same time match traffic growth is questionable due to capital constraints and fleet operation considerations.

- A shift of terminus to the International Airport at Leduc would add up to one hour in travel time for most round trips, along with significantly increased access costs for passengers from Calgary.

- Edmonton's split aviation hub - an International and Municipal Airport - has negative effects on broader-scale travel patterns and levels of service to northern Alberta. One symptom of this problem is evidenced by the fact that Calgary, which has all traffic at one airport, has 63 per cent more scheduled departures than the two Edmonton airports combined.

- Travel time by car and bus is increasing each year with growing congestion on Highway 2, particularly proceeding in and out of the cities during peak traffic hours. Thus, in the future the travel time is likely to increase for the already long journey - 3 to 3.5 hours - particularly for businessmen.

- In light of these developments, it is necessary to explore alternatives which will improve service to Albertans travelling in the corridor, beginning in the mid-1990's. By then, volume/capacity ratios, fare levels and travel times can be expected to have

deteriorated to the point where there will be significant impacts on business and leisure travellers alike. While the current rail service is inadequate, a high-speed rail system would provide a satisfactory alternative to an air journey, and would attract the users of other transport modes as well.

3. THE SOLUTION

- Several alternatives have been put forward to improve air transportation services in the Corridor, such as expansion/improvement of Edmonton's Municipal and/or International Airport, or L.R.T. service to both cities' International Airports. These and other air improvements, however, rely upon jet aircraft, which are becoming increasingly uneconomical in short-haul corridors. A synopsis of the future of Canada's airlines stresses that:

  > the relative lack of productivity gains from new technology in the coming decade will mean that air fares will increase more rapidly in the future than they have over the past two decades.

- The Highway mode and improvements to conventional rail service will not provide the faster travel times which are extremely important to the many business travellers in the Corridor.

- High-speed rail service, as evidenced elsewhere, appears to be technically and operationally capable of meeting the needs of intercity travellers in the Calgary-Edmonton Corridor. It is similar to air in travel time and not much more expensive to the user than the automobile.

- An important advantage that high-speed rail has over the other solutions is that it offers the full recovery of operating and maintenance charges, and of a major proportion of infrastructure investments. In addition, it can offer a good return on investment for the private sector carrier who operates the trains.

- For the operator the capital cost a high speed train is of the order of one-half that of a Boeing 737, and has four times the capacity. Operating costs, including direct energy consumption, are considerably lower as well.

4. THE HIGH-SPEED RAIL SERVICE

- High-speed trains travelling at 200-270 km/h could provide a frequent (10-14 per day), downtown-to-downtown service in less than two hours - in fact, as fast as one hour forty minutes.

- Britain, France, Germany and Japan all operate high-speed trains, some as fast as 270 km/h.

- The Calgary-Edmonton high-speed rail service would feature an entirely new, grade-separated rail line built to 300 km/h specifications and located sufficiently close to Highway #2 to benefit from the adjusted local road patterns.

  There would be one principal downtown, one suburban, and one international airport station at Calgary and Edmonton (the suburban and airport stations in Calgary would be combined).

  Downtown access is an essential characteristic for a successful operation.

- The rolling stock would be based on electric (270 km/h and upwards) technology with each train carrying 350 to 400 passengers; there would be 10 departures per day to start increasing to 14 over time to match growing demand. The study used an arbitrary one-way economy fare, with higher business class fares as well as reduced fares for off-peak and weekend travellers.

- A private carrier would purchase the rolling stock and provide the service (which would cover all the operating costs and pay back a significant portion of the infrastructure investment provided by the government).

- High sophistication in passenger handling, signalling and operating procedures will permit lower cost. Only two persons would be required to operate the train: one driver and one passenger attendant.

5. THE MARKET

- Calgary-Edmonton traffic is characterized by the following modal splits (1981):

Mode	One-Way Trips	Percentage	Trip Purposes
Car	1,372	55.9%	one-third business
Air	664	27.0%	primarily business
Bus	404	16.4%	largely non-business
Rail	18	0.7%	non-business
Total	2,458	100.0%	

- Using Treasury's latest median population forecast and a moderate economic growth (1% per annum), the following corridor traffic is estimated (based on 1981 volumes of 2.46 million with the resulting average annual growth rate of 2.5%):

Year	Total Annual Trips in Corridor
1981	2,458,000
1992	3,397,000
2000	4,216,000
2010	5,354,000
2015	5,871,000

Transport Canada forecasts 5-6% growth in air passengers from 1985 to 1991 in Canada and higher in Alberta; and the Economic Council of Canada estimates around 3% growth for the Province to 2000. Within this context the growth rate for corridor traffic is relatively conservative.

The total trips are one-way movements, excluding through-trips beyond Calgary and Edmonton and also excluding intermediate centres. This assumption provides for a conservative estimate of the potential market.

- Traffic estimates for a high-speed rail service were developed from a survey of thousands of travellers in the Calgary-Edmonton corridor for all modes - air, bus and car. A well-tested modelling approach (developed by British Rail and utilized elsewhere in North America) generated the anticipated trips and from these a multi-fare structure was employed to estimate revenues, based on a 1 hour 40 minute trip time. The following passenger and revenue data are based on commencing operations in 1992 and are given in constant dollars (1983):

Year	Trips	Revenue
1992 (start operations)	1,166,000	40,500,000
1993	1,601,000	55,600,000
2000	2,017,000	71,800,000
2010	2,427,000	91,400,000
2015	2,605,000	99,800,000

These are one-way trips and exclude through-trips beyond Calgary and Edmonton as well as those associated with intermediate centres.

- Many of the trips taken on a high-speed train would be associated with overall growth of the travel market (up 50% by 1995). The table below shows how prospective train passengers would travel in the absence of rail service. This, of course, makes the assumption that relative price and service quality levels for bus, auto and air are unchanged over time.

Mode	Percentage of Ridership	Percentage of Each Mode
Air	45%	75-80%
Car	20%	15-20%
Bus	20%	40-45%
Generated	15%	N/A

Note that 15% of these trips would not be taken if the rail service were not provided. They are in effect "generated" by the new travel possibilities opened to the public by fast trains.

- It is expected that, after a year or two to position itself in the market, high-speed rail will account for 38% of all trips originating in Calgary and terminating in Edmonton - or vice versa. While this is a very significant market share, it is important to remember that it represents only a small proportion of all auto traffic on Highway 2. Most car trips are less than 50 miles in length.

- Even though growth in corridor travel will cushion the effect, there will be a re-allocation of traffic amongst the modes, should a high-speed rail service be implemented. Fortunately, the lead times envisioned are sufficiently long that proper physical and financial planning can be undertaken to permit a harmonious introduction of rail in the decade ahead.

6. THE COSTS

- There were three alternative high-speed service designs that were costed for analysis. The "base case" employed had electric trains (270 km/h) with a 1:40 travel time. Its results are described below.

Roadbed, etc.[1] (passive elements)	$370.2	
Track, etc.[2] (improvements)	$454.2	
Total Infrastructure	$824.4	in 1983 dollars
	($1,100.0)	in "as spent" dollars[3]
Carrier Operating Assets[4]	$102.8	

1. Includes right-of-way, grading, fencing, structures, sub-ballast and ballast
2. Includes ties, track, electrification, signalling, stations and downtown accesses.
3. Based on 5% annual inflation and completion by 1992.
4. Includes rolling stock, maintenance facilities and working capital.

- The investment in "Roadbed, etc.", does not generate direct revenue or cash flows and is considered to be a passive investment necessary to establish the high-speed rail service. On the other hand, the investment in "Track, etc.", generates sufficient revenues to pay all maintenance costs plus make a moderate return on the capital invested.

7. FINANCIAL PROJECTIONS

- Financial projections were developed in constant 1983 dollars and subject to the following key assumptions reflecting current market conditions:

  Government-Related

  - discounted at a real interest rate of 5%;

  Carrier-Related

  - long-term financing costs at 12%;
  - interest revenue at 10%.

  The primary measure of financial viability is the internal rate of return which is the discount rate at which the present value of cash inflows equals the present value of cash outflows.

- The private carrier provides 30 per cent of his investment on an equity basis with conventional financing funding the remaining 70 per cent. The carrier will also fund all infrastructure maintenance costs through a user fee to the Province.

- Forecast financial statements for the private operator were prepared and provide balance sheet, income and cash flow results from the proposed investment. The following table provides a summary of the financial projections for operations over a 25-year period from 1992 to 2016 (in 1983 constant dollars):

Base Case
Financial Projections
($ Millions)

	Year					
	1	5	10	15	20	25
Gross revenue	$40.5	$62.2	$73.6	$84.2	$93.2	$101.3
Profit (loss) from operations	12.6	32.8	42.1	49.8	58.9	67.0
Net profit (loss) from operations	(2.6)	1.7	5.7	9.1	15.0	22.1
Net cash from (for) operations[1]	16.2	37.0	46.2	54.7	63.8	71.8
Net cash flow before other items[2]	0	4.2	7.2	10.9	16.1	22.9
Net cash flow[3]	1.5	4.1	6.7	10.1	14.8	20.9

1. Gross revenues less carrier's operating costs including infrastructure maintenance.

2. As above less infrastructure user fee, interest payments and taxes.

3. As above less dividends and additions to rolling stock; plus proceeds from shares issued and long-term debt issued.

- The results clearly indicate the financial viability of establishing a separate corporate entity to operate the intercity high-speed rail service. The private carrier achieves a net profit from operations of $1.7 million in Year 5 increasing to $22.1 million in Year 25. These figures do not include the sources of revenue from package and mail delivery or lease revenues from the fibre optic line.

8. INVESTMENT ANALYSIS

- The results of the investment analysis based on 25 years of operations starting in 1992 can be summarized as follows:

INVESTMENT ANALYSIS

	Capital Cost ($ Millions)	Net Present Value ($ Millions)	Internal Real Rate of Return
Private Carrier			
Train Operations:			
Operating Assets*	$102.8	+ $70.3	+ 14.9% (after tax)
Province of Alberta			
Infrastructure:			
Track, etc. (improvements)	$454.2	- $24.2	+ 4.5%
Roadbed, etc. (passive)	$370.2	n/a	n/a
Total Project Cost	$927.2	- $306.6	+ 1.3%

* Financed 30% equity and 70% debt funding.

- The 14.9% real rate of return for the private carrier is generally in line with investor expectations recognizing current interest rates and other available returns.
- The project will generate sufficient cash flow to provide an internal rate of return of 4.5% per annum (excluding inflation adjustments) on the investment in track and other infrastructure improvements by the Province. Even when the passive element is included, the overall rate of return is still positive at 1.3% real (which is a low average long-run return on capital).
- The financing approach outlined above presents a credible method of structuring the proposed investment, however, other alternatives could be instituted.
- Cost Sensitivity Testing: Internal Rates of Return (Real)

Project Component	Base Case	Operating Costs Up 10%	Capital Costs Up 10%
Operator	14.9%	13.7%	12.7%
Infrastructure	4.5%	3.9%	3.6%
Total Project	1.3%	0.9%	0.7%

None of the downside risks for cost estimates significantly reduce the viability of the project, i.e., all IRR's are positive and at reasonable levels. (Discount rates have no impact on IRR's.)

- One way of assessing the economic performance of any transport infrastructure investment is to compare cost recovery levels.

	Cost/Recovery Ratio
High-Speed Rail	68%
Road (National)	39%*
Road (Alberta)	12%*
Air	36%*

(*Transport Canada, 1979)

Although these percentages are not derived in the exact same manner, they do allow for "order of magnitude" comparison. For every dollar of expenditure on high-speed rail infrastructure in Alberta, 68¢ would come from the user and 32¢ from the taxpayer; for airports, 36¢ came from the user and 64¢ from the public treasury while for road, 12¢ came from the user and 88¢ from government. The high-speed rail cost recovery ratio is significantly higher demonstrating a stronger economic performance than found acceptable for other modes.

- The high-speed rail service will not likely obviate the need for future investment in Highway 2, although it may postpone the need to expand congested segments by reducing flows at the city approaches at peak times (possibly through the addition of commuter rail services).

9. THE DIRECT AND INDIRECT BENEFITS TO ALBERTA

- The nature and magnitude of the investment in high-speed rail would generate significant economic benefits for the Province and the Canadian economy. It is estimated that there would be substantial direct employment benefits to Alberta resulting from consulting, construction and operations activity. Indirect employment would also be generated as would induced employment reflecting a multiplier effect. The leakage to the rest of the country is expected to be of a similar amount in terms of employment and expenses.

	Estimated man-years		Expenses (Millions $)	
	Direct	Total	Direct	Gross-Output
Construction	7,745	20,020	$505	$1,994
Consulting & Manufacturing	1,445	5,025	70	$ 242
Total	9,190	25,045	$575	
Operations (Annual)	285	590	$ 21	$ 35

- In light of the slack in the present provincial economy, these economic spin-offs from the high-speed rail project would have a maximum and fully positive impact in Alberta. Furthermore, the location of the line, with much of it in rural Alberta, will ensure that many of these benefits will be realized outside the two major metropolitan centres.

- There would be $315 million in new federal and provincial income taxes as well as any taxes generated by indirect activities, corporate or personal.

- Overall, it is evident that the benefits estimated are more than sufficient to offset the government's passive investment in the roadbed, etc. In fact, the benefits are several times the level of provincial funding - keeping in mind that a large portion of the total cost is recovered with interest along with covering annual maintenance costs over the initial 25 years of operation.

- Given the magnitude of the role of high-speed rail, capturing as it does 38% of Calgary-Edmonton traffic, there will likely be opportunities to reschedule other transportation infrastructure expenditures.

10. THE EXTERNAL SPIN-OFF BENEFITS

- The introduction of the high-speed rail service would result in the rationalization of air services which could affect scheduling of investments in airports. For example, the proposed new runway in Calgary could be delayed or new infrastructure in Edmonton could be concentrated at the International Airport eliminating duplication of capacity.

- Alberta would become a world leader in the kind of specialized high-speed rail concept described. Success "on the job" would be marketable elsewhere, particularly in advanced technological componentry: electrical propulsion, electrification, signalling and communications control systems. There could be a North American market for the Alberta high-speed rail concept, in technological exports and for engineering/planning expertise.

- The successful treatment of the high-speed rail mode as advocated in Alberta would suggest answers to the Federal Government for many rail problems in general, and in particular with regard to investment decision methods across several modes as well as institutional arrangements.

- Safety would be enhanced, as properly-operated and grade-separated rail services are known to be much safer than the other modes.

- Alberta would become more attractive to tourists, conventioners, etc.

11. THE INSTITUTIONAL ARRANGEMENTS

- The general North American approach to transportation infrastructure and service has been used: government provides the infrastructure (as it does for roads, air and marine facilities, etc.) while a private carrier similar to an airline or bus company operates the service. Rail is the exception, having to fund the carrier function and pay for infrastructure on its own. The approach here has been to follow the North American pattern for road, air and water as this is the most appropriate way to assure a freely working, unbiased market.

- The specifics of the market to be served and the solution chosen make it imperative that new institutional arrangements replace the traditional. In many ways, this project will have to be organized like an "airline on the ground". In others, particularly rail operations, the approaches used in modern light rail transit are more likely to prove appropriate than are those used to optimize the movement of 10,000 tonne freight trains.

- There is the potential for multiple use of the rail line (for example, by L.R.T. for suburban services; a regional authority for commuter services.) Additionally, the rail line has been designed to accommodate a fibre optics line, of interest to Alberta Government Telephones.

12. THE KEY ASSUMPTIONS

- There will be moderate economic growth in Alberta, accompanied by corresponding population growth and travel demand between Calgary and Edmonton.

- The Airbus service likely will change over time in response to a variety of factors - noise constraints at Edmonton Municipal Airport, the changing economics of very short-haul jet services, and eventually from integration of air with rail services.

- There will be a near-complete break from traditional railway institutional, operating, regulatory and financing procedures.

- The rail project will be evaluated as a candidate for government funds on the same basis as projects involving other transport modes (i.e., the carrier is private, the infrastructure is public, and the rail service is credited with the full range of spin-off benefits).

- No unforeseen technical problems of a serious nature present themselves when detailed engineering is carried out. However, large contingency allowances have been included in cost estimates.

13. THE OVERALL CONCLUSIONS

- The Calgary-Edmonton high-speed rail project will be required to serve the corridor in the future and it has proven to be technically feasible, financially viable and attractive to corridor travellers.

- The private operator of the service would receive a good rate of return (+14.9% real, after tax) on his investment while covering the annual maintenance costs of the infrastructure. Thus, there will be no ongoing operation subsidies by the government.

- The project would provide substantial spin-off benefits for the Province's engineering and construction industries during the crucial economic recovery period.

- The high-speed line would not be just another government-financed transportation project: rather, it would produce an operating profit for the private operator upon introduction and contribute to its infrastructure costs at a rate higher than most, if not all, road and air projects.